January 4, 2008

Mr. Eldridge Mathis
Lighthouse Baptist Church
325 Church St.
West Columbia, SC 29172

Dear Mr. Mathis,

This letter will provide you and the others at Lighthouse Baptist Church with the results of our field investigation on your property. I am also including our invoice for the study and will appreciate you passing it on to the appropriate individual.

The study was conducted on Wednesday, January 3, 2008 and required about 3 person hours at the site. This work was undertaken at the request of the church to assist in the identification of a possible cemetery to the south of the church building. In this area there is an area adjacent to the church drive and in the vicinity of three cedar trees that has been reported to be a cemetery.

Methods

A penetrometer is a device for measuring the compaction of soil. Soil compaction is well understood in construction, where its primary objective is to achieve a soil density that will carry specified loads without undue settlement and in agronomy where it is recognized as an unfavorable by-product of tillage.

In the most general sense, the compaction of soil requires movement and rearrangement of individual soil particles. This fits them together and fills the voids that may be present, especially in fill materials. For the necessary movement to occur, friction must be reduced, typically by ensuring that the soil has the proper amount of moisture. If too much moisture is present, some will be expelled and in the extreme, the soils become soupy or like quicksand and compaction is not possible. If too little is present, there will not be adequate lubrication of the soil particles and, again, compaction is impossible. For each soil type and condition, there is an optimum level to allow compaction.

When natural soil strata are disturbed – whether by large scale construction or by the excavation of a small hole in the ground – the resulting spoil contains a large volume of voids (air) and the compaction of the soil is very low. When this spoil is used as fill, either in the original hole or at another location, it likewise has a large volume of voids and a very low compaction.

In construction, such fill is artificially compacted, settling under a load as air and water are expelled. For example, compaction by heavy rubber-tired vehicles will produce a change in density or

compaction as deep as 4.0 feet. In agriculture, tillage is normally confined to dry weather or the end of the growing season – when the lubricating effects of water are minimized.

In the case of a pit, or a burial, the excavated fill is typically thrown back in the hole not as thin layers that are compacted before the next layer is added, but in one, relatively quick episode. This prevents the fill from being compacted, or at least as compacted as the surrounding soil.

Penetrometers come in a variety of styles, but all measure compaction as a numerical reading, typically as pounds per square inch (psi). The dickey-John penetrometer, which I use, consists of a stainless steel rod about 3-feet in length, connected to a T-handle. As the rod is inserted in the soil, the compaction needle rotates within an oil filled (for damping) stainless steel housing, indicating the compaction levels. The rod is also engraved at 3-inch levels, allowing more precise collection of compaction measurements through various soil horizons. Two tips (½-inch and ¾-inch) are provided for different soil types.

Of course, a penetrometer is simply a measuring device. It cannot distinguish soil compacted by natural events from soil artificially compacted. Nor can it distinguish an artificially excavated pit from a tree throw that has been filled in. Nor can it, per se, distinguish between a hole dug as a fire pit and a hole dug as a burial pit. What it does is convert each of these events to psi readings. It is then up to the operator to determine through various techniques the cause of the increased or lowered soil compaction.

For example, soils that have been artificially compacted frequently exhibit compaction levels that are significantly above normal soil readings. And as for distinguishing a burial pit from other, natural, events, this is typically done by carefully marking out the size, shape, and orientation of the area of lesser compaction.

Penetrometers are used by forensic anthropologists (such as Drs. Dennis Dirkmaat and Steve Nawrocki) and by the Federal Bureau of Investigation (Special Agent Michael Hockrein) in searches for clandestine graves. While a penetrometer may be only marginally better than a probe in the hands of an exceedingly skilled individual with years of experience, such ideal circumstances are rare. In addition, a penetrometer provides quantitative readings that are replicable and that allow much more accurate documentation of cemeteries. In fact, as will be discussed here, our research in both sandy and clayey soils in Virginia, North Carolina, South Carolina, and Georgia suggests very consistent graveyard readings.

Like probing, the penetrometer is used at set intervals along grid lines established perpendicular to the suspected grave orientations. The readings are recorded and used to develop a map of probable grave locations. In addition, it is useful to "calibrate" the penetrometer to the specific site where it is being used. Since readings are affected by soil moisture and even to some degree by soil texture, it is important to compare readings taken during a single investigation and ensure that soils are generally similar in composition.

It is also important to compare suspect readings to those from known areas. For example, when searching for graves in a cemetery where both marked and unmarked graves are present, it is usually appropriate to begin by examining known graves to identify the range of compaction present. From work at several graveyards, including the Kings Cemetery (Charleston County, South Carolina) where 28 additional graves were identified, Maple Grove Cemetery (Haywood County, North Carolina) where 319 unmarked graves were identified, and the Walker Family Cemetery (Greenville County, South Carolina)

where 78 unmarked graves were identified, we have found that the compaction of graves is typically under 150 psi, usually in the range of 50 to 100 psi, while non-grave areas exhibit compaction that is almost always over 150 PSI, typically 160 to 180 psi.

For example, at Kings Cemetery it was possible to produce several compaction cross sections through cultivated fields, old (fallow) fields, woods, roads, bulldozed areas, and cemetery areas. Particularly important were the location of graves made obvious by either monuments or sunken grave shafts.

Cultivated areas and burials both revealed compaction readings under 100 psi. Of course the two areas could be distinguished from each other by the depth of the various compaction readings. The cultivated fields were underlain by soils with compaction readings between 200 and 300 psi, usually within 0.8 foot of the surface. Burials, on the other hand, revealed the lower compaction readings to depth of 3.0 feet.

The roads and other disturbed areas, such as where bulldozers had recently been operated, exhibited compaction levels of over 300 psi. In such areas it is usually impossible to distinguish burials – they are effectively "masked" by the increased soil density.

Between burials, in areas where there was no evidence of burials, compaction ranged from 101 to 300 psi. This suggests that in some areas there may have been earlier graves, at least partially masked by more recent, intrusive graves.

After the examination of over 30 cemeteries using a penetrometer, we are relatively confident that the same ranges will be found throughout the Carolinas and Georgia. It is likely these ranges are far more dependent on general soil characteristics (such as texture and moisture) than on cultural aspects of the burial process.

The process works best when there are clear and distinct non-grave areas, i.e., when the graves are not overlapping. In such cases taking penetrometer readings at 2-foot intervals perpendicular to the supposed orientation (assuming east-west orientations, the survey lines would be established north-south) will typically allow the quick identification of something approaching the mid-point of the grave. Working along the survey line forward and backward (i.e. north and south) will allow the north and south edges of the grave to be identified. From there, the grave is tested perpendicular to the survey line, along the grave's center-line, in order to identify the head and foot.

Typically the head and foot are both marked using surveyor's pen flags. We have also found that it is helpful to run a ribbon of flagging from the head flag to the foot flag, since the heads and feet in tightly packed cemeteries begin to blur together.

Implemented Methods

The described methods were used at the Lighthouse Baptist Church with one exception. There were no known graves available to used in calibrating the penetrometer. Thus, it was necessary to examine a relatively large area before it was possible to begin identifying individual graves. I found that soil compaction varied considerably. In the immediate area of the cedar trees the soil compaction ranged from about 25 to 80 psi. About 50 to 75 feet south of the church drive, the compaction increased to 200-300 psi.

Individual graves were marked in the field and a sketch map was prepared prior to the completion of the work.

Findings

I identified an area measuring about 50 by 80 feet with very loose soils (<100 psi) to depths of at least 3 feet – consistent with a cemetery. Beyond this relatively small area, however, soils exhibited significantly greater compaction (>200 psi). This appears significantly higher than I would anticipate for Lakeland series soils (identified on the study site).

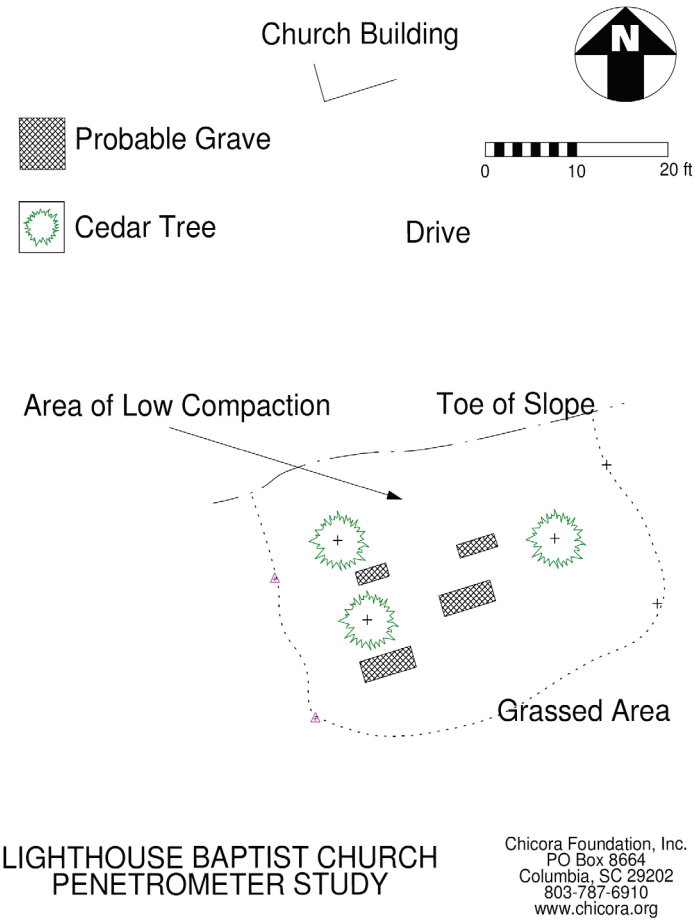


Figure 1. Sketch map of the penetrometer study findings.

I was eventually able to identify four clear graves and these were marked in the field. Please understand that I expect there are more graves – these were the ones that were sufficiently clear that I was able to discern them and establish good boundaries. These graves are shown in the sketch map (Figure 1).

Historical Data

At the conclusion of my study a neighbor to the southeast volunteered a 1960 plat (Lexington County Register of Deeds, PB 52G, pg. 140) showing a 2.73 acre parcel then owned by Charles W. and Mary Ann Shumpert (Figure 2). This plat reveals a cemetery established with four permanent corners measuring about 0.4 acre. Figure 3 compares this plat to the modern property layout in order to help you orient what you are looking at.

The location of this cemetery is superimposed over a 2003 aerial of the church property in Figure 4. You can see that the cemetery includes all of the church property south of the main church building. Portions of the cemetery have been built over – two structures are shown on the aerial as being in the cemetery.

Figure 5 shows aerial photographs from 1989 and 1996. These aerials reveal that in 1989 a mobile home was set in the cemetery. By 1996 this mobile home had been moved off the cemetery, but two other buildings were still present.

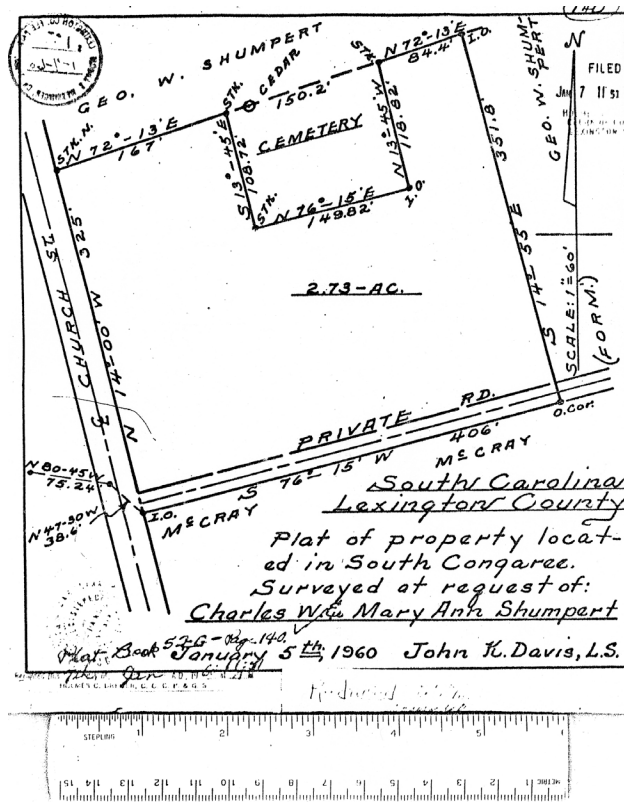


Figure 2. 1960 plat of Charles W. and Mary Ann Shumpert property showing the 0.4 acre cemetery.

The variety of structures, automobiles, and driveways that have been put on the cemetery explain the very high compaction levels I encountered to the south (I understand that this area is still being used to park cars during services). The activities documented by the aerial photographs fully explain why no graves could be identified except for the small area where the cedar trees precluded construction activities.

Recommendations

I am not attorney and cannot offer legal advice. However, I recommend the church elders carefully examine the church's deed. With the 1960 plat clearly showing the cemetery, I would have expected that the deed for the church property would have indicated the presence of the known and marked cemetery. Typically title searches go back about 30-40 years. With the church being approximately 25 years old (ca. 1982), I believe that most title searches would have gone back to the early 1950s – certainly far enough to have identified the plat and the cemetery it shows.

I mention this because South Carolina Code of Laws, Section 16-17-600 et seq., Destruction or Desecration of Human Remains or Repositories, makes it a felony to damage or disturb human remains. Given the extensive construction activities on the property, it is possible that human remains have been disturbed (for example, I expect that the mobile home on the property had a well and a septic field). The elders may wish to consult with an attorney concerning the church's liability in the matter.

In any event, I consider the entire 0.4 acre tract to the south of the main church lot to be a cemetery and I recommend that no additional construction take place on the green

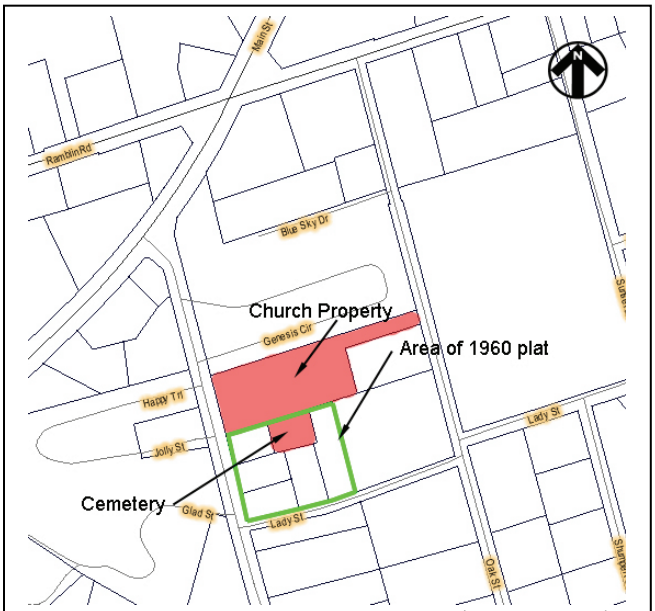


Figure 3. Overview comparing the 1960 plat (Figure 2) with the modern property boundaries.

Figure 3. 2003 aerial showing the cemetery.

Figure 4. Aerial photographs from 1989 (left) and 1996 (right) showing the cemetery and the variety of impacts to it.

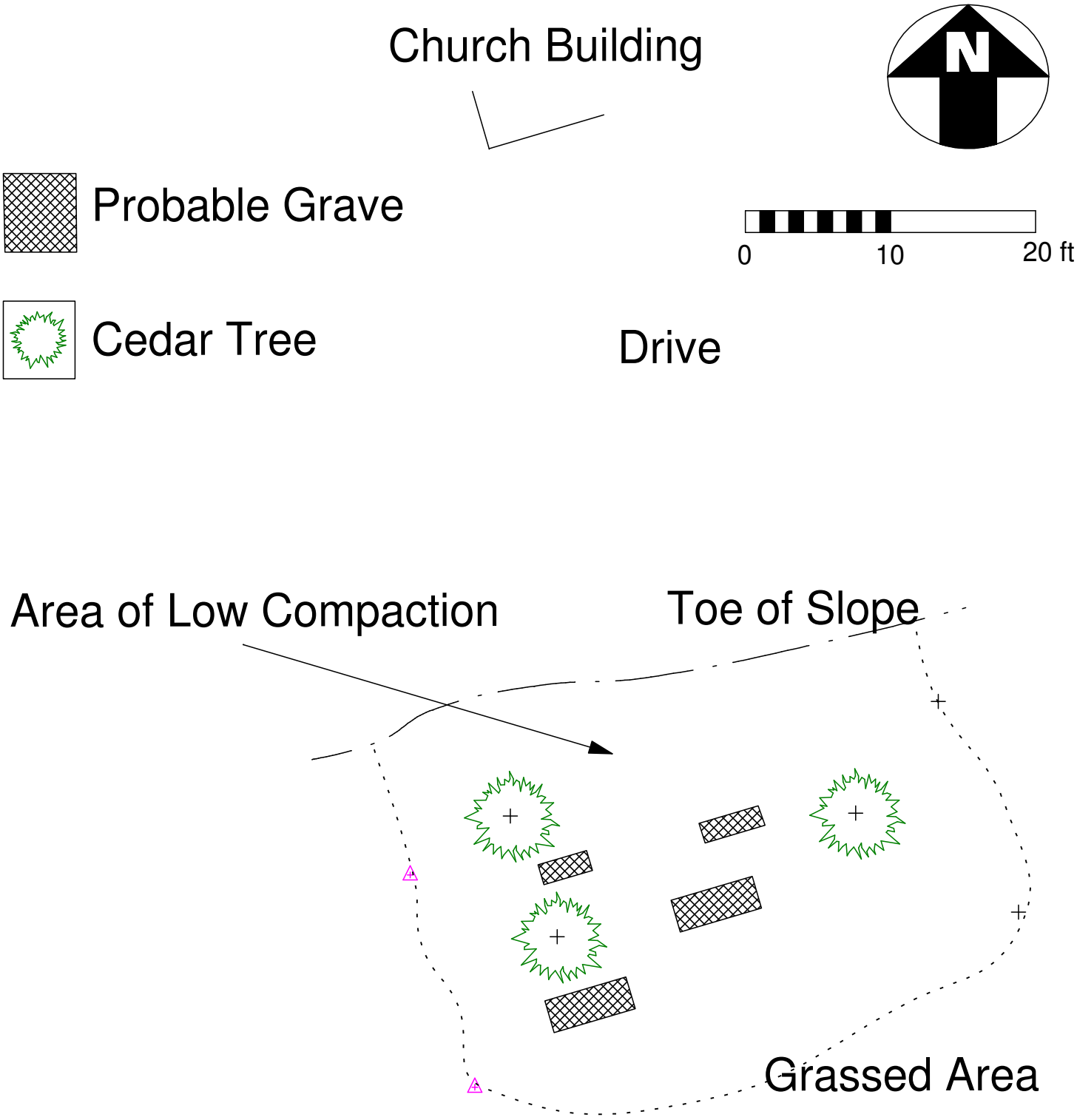
outlined area shown in Figure 3. I also recommend that no parking be allowed in this area, since it is probable that the cars are being parked on graves.

If you or the elders have any questions I will be happy to attempt to answer them. I appreciate the opportunity to provide this service.

Sincerely,

Michael Trinkley, Ph.D.
Director

Enclosure (invoice)



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PENETROMETER STUDY

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